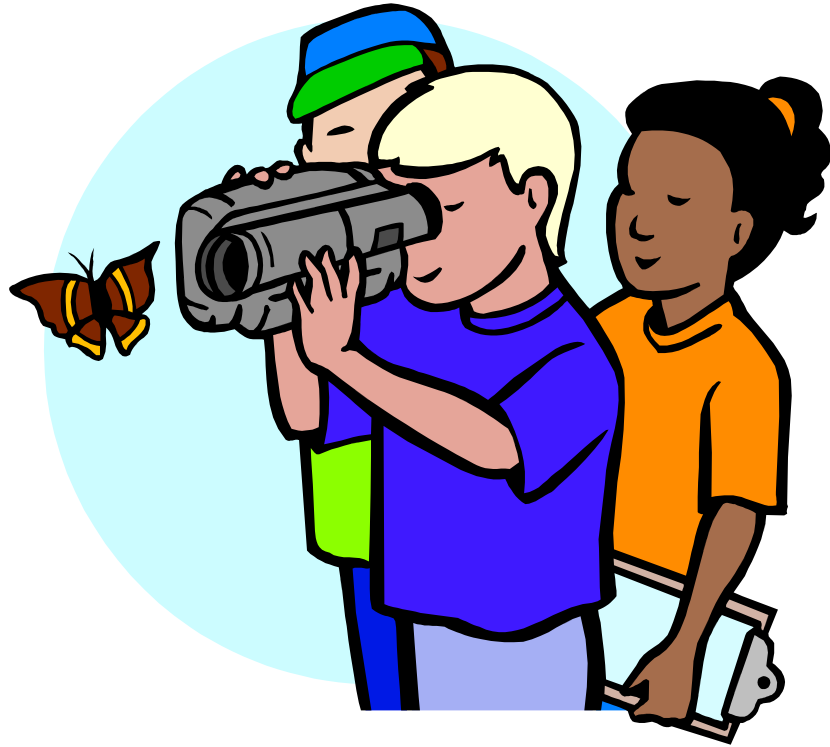


SCIENCE FAIR "HOW-TO" PACKET



Forest Park Elementary
2009

FIRST THINGS FIRST!

RULES OF THE GAME...

No. 1: Choose A Topic That Interests *YOU!*

Hey, it's a simple fact of human nature. People like to do things that interest them, and they hate to spend time slogging away on things they hate. I can't count the times I've heard science fair students tell me that they got stuck doing a project that their teacher thought was interesting, or that a parent thought "should" interest them. There's no quicker way to make someone hate science!

It doesn't matter what someone else thinks should interest you. If you want to get a good grade or win your science fair, or even just not hate the whole experience, then you must pick a topic that interests you.

Fortunately, since science encompasses absolutely everything in the Universe, that shouldn't be too hard to do!

Start by asking yourself what you enjoy doing.

Do you enjoy sports? Then let the field become your intellectual playground. Test different balls, gloves, dirt or grass associated with sports.

Do you enjoy music? Then sound, tonality, esthetics, music preference, performance ability with practice, musical memory (how musicians can memorize sequences of thousands of notes perfectly but not sequences of anything else), audio illusions, electronic music, song lyrics, and on and on are all great subjects for you to explore.

Frankly, it doesn't matter what you like to you do. To turn it into a science project you simply have to start thinking about how people do the things that you enjoy and you'll find science projects waiting for you in every nook-and-cranny of your interest. **ASK A QUESTION!**

No. 2: Follow the KYSS Principle--Keep Your Science Simple

One of the great universal truths of science that every scientists knows is this--the simpler your experiment is to carry out, analyze, and understand, the more likely you are to succeed. Here are a few tips to keep in mind that will help you **keep it simple!**

First, make sure you begin with a clearly stated, very straightforward and *very narrow* question. Science makes progress by focusing in on the smallest bite-sized questions that lead to a concrete result... Students often get themselves into trouble right off the bat by asking questions that are confused, complicated or address an issue too broadly.

Here are some good questions:

- What concentration of alcohol is needed to kill 50 percent of the germs on a surface?

- Does the heart rate of an earthworm increase with exercise?
- How does skin elasticity change with age?
- How does the amount of soot in the atmosphere change when it rains or snows?

Here are a few bad questions:

- How does heat affect different liquids? (Too vague. Which liquids? What does "affect" mean exactly? Also, the question is confused. Liquids boil, freeze or break when they reach certain *temperatures*. Heat and temperature are NOT the same thing. **So, correct the confusion and be highly specific: How does the boiling temperature of water vary with concentration of dissolved salt and sugar?**)
- Which detergent works best? What detergent and works best means what? A better question would be: **Which laundry detergent, Tide, Cheer or Surf, will remove the greatest amount of the oil stain?**
- **Stay away from statements like best, better, most, some, and other non-measurable units. Make your question specific and easy to understand by the reader.**

Also, when you are designing your experiment, always ask yourself is there a simpler way to get the data, an easier way of understanding the results, a clearer way of presenting your findings, a way to explain them in fewer words. Let "economy in all things" be your motto and you will have a successful project.

No. 3: Do Your Own Work

Remember; when you get to the fair, spectators expect the project to be your work. How can you talk about it if you didn't actually do it yourself? Getting help on a few specific aspects of your project is okay and often necessary. Buy YOU must do the project yourself. Don't let a parent or another adult do all the work for you. You won't gain anything, and you will be embarrassed come judging day. **Parents, since this is a learning experience for your children please let them succeed in this venture. The child will need some help possibly with the experiment phase of the project. I know we all want our children to be successful and/or the winner, but please allow them to learn on their own.**

You can teach a student a lesson for a day; but if you can teach him to learn by creating curiosity, he will continue the learning process as long as he lives. ~Clay P. Bedford

*Children have to be educated, but they have also to be left to educate themselves.
~Abbé Dimnet, Art of Thinking, 1928*

We learn more by looking for the answer to a question and not finding it than we do from learning the answer itself. ~Lloyd Alexander

No. 4: Give Yourself Plenty of Time

For your project to be the best you can make it, you must allow yourself plenty of time to get it done. Please utilize the **timeline** and the **specific steps of the scientific method**, attached to this

packet. A good project can't be done the night before the fair or even a few days before. A good project requires weeks of planning and experimentation to be successful.

So you've got a science fair project due....Don't worry! Whether you love science or wish Newton had never been born, a science fair project can be a great experience. The secret is knowing how to get started and how to keep moving until your project is finished. To help you, I've assembled this list of the nine essential steps you'll need to create a science fair project that will kick tail come judging day.

If you follow these simple steps, you'll not only achieve science fair success, but you're likely to have a lot more fun with a lot less heartache.

• Step 1: Select Your Topic

First, you'll need to select a great science fair topic.

What makes for a great topic? Well, since science encompasses the entire Universe, just about anything can be the basis for a championship science project. Just remember two things. The science project needs to be interesting to *you*, personally. And secondly, it needs to be something that is simple and easy to carry out.

Examples

What kind of juice cleans pennies best?

Do watches keep time the same?

How does omitting an ingredient affect the taste/look of a cookie?

Do suction cups stick equally well to different surfaces?

What brand of raisin cereal has the most raisins?

Which dish soap makes the most bubbles?

Which paper towel is the strongest?

With which type of battery do toys run the longest?

Which laundry detergent works the best?

Do roots of a plant always grow downward?

Can plants grow without soil?

Will bananas brown faster on the counter or in the refrigerator?

Does temperature affect the growth of plants?

Can plants grow from the leaves?

Do different kinds of apples have the same number of seeds?

Do bigger seeds produce bigger plants?

Of what is the soil in my schoolyard made?

Does a plant grow bigger if watered with milk or water?

Can the design of a paper airplane make it fly farther?

Do wheels reduce friction?

What holds two boards together better a nail or a screw?

Does a ball-roll farther on grass or dirt?

Do all objects fall to the ground at the same speed?

What kind of things do magnets attract?

How can you measure the strength of a magnet?

How much salt does it take to float an egg?

Does water with salt boil faster than plain water?

Does an ice cube melt faster in air or water?

Can you tell what something is just by touching it?

Can you tell where sound comes from when you are blindfolded?

Can things be identified by just their smell?

Does the length of a vibrating object affect sound?

Does a bath take less water than a shower?

Does warm water freeze faster than cool water?

How long will it take a drop of food dye to color a glass of still water?

Which materials absorb the most water?

What materials dissolve in water?

Which dissolves better in water - salt or baking soda?

Does an earthworm react to light and darkness?

Does surrounding color affect an insect's eating habits?

Do different kinds of caterpillars eat different amounts of food?

How do mealworms react to various surfaces?

Do mealworms prefer light or dark environments?

Which lubricants make it most difficult to pick a screwdriver?

Which brand of popcorn pops the most kernels?

Which brand of popcorn pops the fastest?

Which brand of diaper holds the most water?

What type of cleaner removes ink stains best?

Which brand of soap makes the most suds?

Which plastic trash bag is the strongest?

Which houseplant fertilizer works best?

Does temperature affect the results of a soft drink challenge?

Which brand of disposable diaper absorbs the most liquid?

Do different types of soil hold different amounts of water?

Will adding bleach to the water of a plant reduce fungus growth?

Does sugar prolong the life of cut flowers?

How much of an orange is water?

Does the color of light affect plant growth?

Do plants grow bigger in soil or water?

How much weight can a growing plant lift?

Does it matter in which direction seeds are planted?

Do living plants give off moisture?

What plant foods contain starch?

Which liquid has the highest viscosity?

Will more air inside a basketball make it bounce higher?

Do all colors fade at the same rate?

Does a baseball go farther when hit by a wood or metal bat?

What kind of glue holds two boards together better?

Does the width of a rubber band affect how far it will stretch?

Can you use a strand of human hair to measure air moisture?

How far can a water balloon be tossed to someone before it breaks?

Does the shape of a kite affect its flight?

Using a lever, can one student lift another larger student?

What gets warmer faster-sand or soil?

In which way does the wind blow most frequently?

Will a ball bounce higher if it is dropped at a greater distance from the floor?

Do sugar crystals grow faster in tap water or distilled water?

What common liquids are acid, base or neutral?

What determines how fast a piece of candy dissolves?

Will a rubber band stretch the same distance every time that the same amount of weight is attached to it?

Does baking soda lower the temperature of water?

Does the color of water affect its evaporation?

Can you separate salt from water by freezing?

Will water with salt evaporate faster than water without salt?

What type of soil filters water best?

How do different environments affect the regeneration of planarians?

How do day-old domestic chicks behave?

What are the humidity preferences of a flour beetle?

How does earthworm population relate with soil type?

Which videotape maintains the best picture for the greatest amount of use?

Which home smoke detector is most sensitive?

Which engine oil reduces friction the most?

Which home insulation works best?

Which self-adhesive floor tile resists wear the most?

What type of oil has the greatest density?

How is the rate of melting snow affected by color?

Which type of sunglass lens blocks the most light?

Which materials keep ice cubes from melting for the longest time?

Which amount of air space is the best insulator for storm windows?

Does a green plant add oxygen to its environment?

What percentage of corn seeds in a package will germinate?

How much of an apple is water?

Does a plant need some darkness to grow?

What are the effects of chlorine on plant growth?

How does centrifugal force affect the germination of corn seeds?

How does light direction affect plant growth?

How does light direction affect plant growth?

Which type of line carries sound waves best?

Which metal conducts heat best?

Can same-type balloons withstand the same amount of pressure?

Does the viscosity of a liquid affect its boiling point?

What materials provide the best insulation?

What keeps things colder - plastic wrap or aluminum foil?

Do liquids cool as they evaporate?

Does the size of a light bulb affect its energy use?

For how long a distance can speech be transmitted through a tube?

Does the color of a material affect its absorption of heat?

Does sound travel best through solids, liquids or gases?

Is the amount of erosion affected by the slope of land?

How much heat is absorbed by a closed automobile?

Can the sun's energy be used to clean water?

• Step 2: Do Your Homework

After selecting your topic, learn as much as you reasonably can about it.

The Internet is likely to be your best resource. You can use the many search engines available to find information.

THESE ARE GREAT SITES!

<http://www.scifair.org/dr.shawns4fundamentalrules.html>

<http://www.all-science-fair-projects.com/>

<http://www.kathimitchell.com/scifair.htm>

<http://www.scienceproject.com/projects/index/elementary.asp>

<http://school.discoveryeducation.com/sciencefaircentral/Getting-Started.html>

<http://www.juliantrubin.com/sitemap.html>

<http://members.ozemail.com.au/~macinnis/scifun/projects.htm#N42>

Whatever you do, don't forget about your **local library**. The Web generally contains only general information. If you want to get into the advanced details of some subject, textbooks written by world experts are by far the best references. Also, if you want to look up any research papers you find referenced in your study material you will probably have to head into the stacks to find them.

Also, always make sure you introduce yourself to the **reference librarian** as soon as you walk through the door. Their job is to help you find the information you're looking for. Consider them your **secret weapon** for science fair success. So *don't BE SHY!*

• Step 3: Plan

Once you consider yourself an expert about your topic, plan your road ahead. Your plan should include the following:

1. Devise a simple and clear sentence that states the purpose of your experiment. What do you want to find out? Remember, the shorter the statement, the better it will be.
2. Figure out what the "variable" will be in your experiment. That is, what things or conditions (temperature, light, amount of fertilizer in the soil, noise, etc.) that you are going to change to see how whatever it is that you are testing (seedlings, a mechanical clock, the ability to shoot hoops, etc.) reacts.
3. If you think you know enough to have a good idea about what may happen, then make an educated guess as to what you think will happen. We call an educated guess like this a "hypothesis." Remember, your experiment will test your hypothesis. That is, it might prove it wrong, but it can never *prove* it to absolutely unquestionably right. Science advances when scientists set out to prove ideas wrong. If the idea withstands rigorous testing, only then should you have any confidence in it.
4. Next, you'll need to devise a detailed procedure outlining exactly how you will conduct the experiment. Step-by-step! Remember, doing science is all about NOT FOOLING YOURSELF! So ask yourself at each step what you need to do to make absolutely certain that errors or outside influences aren't creeping in that can affect your experiment without you knowing about it. This is the most critical part of the whole process!
5. Finally, think about the data you are going to get. How will you make sense of it? What will you do to figure out what it all means? Will you average it, plot it, and find its standard deviation? You must know in advance what you will do to analyze your data, lest you fall into the trap of looking at the results, and then selecting a method of analyzing it that unfairly favors your hypothesis. There may be no easier way for you to fool yourself!

• Step 4: Prepare

Gather together everything you will need to carry out your experiment. Get everything set up and negotiate with family members for any time and space you will need to complete the experiment. (Need to borrow the corner of your brother's closet to grow your test plants? Make sure everyone in your family knows and agrees before you start your experiment.)

Whatever you do, don't forget to secure your own **personal science fair notebook (LOG BOOK)**. Your **LOG BOOK** will be the most valuable aid you have. In it, you will summarize your Internet and library research, detail your hypothesis, carefully describe your experiment's design, record all your data, and work through all your analysis. When something unexpected happens, you must write that

down as well. Your goal should be to write down enough information so that someone reading your notes would be able to exactly duplicate what you did.

Remember the old Chinese saying: No memory is as firm as faded ink!

Have you ever been certain of some fact only to discover that you had remembered it wrong? So never rely on memory! Your personal motto when it comes to laboratory notebooks (yours or anyone else's) should be, "If it isn't in the log book, it didn't happen."

• **Step 5: Do The Experiment!**

Now, follow your written plan. While conducting the experiments make sure you keep detailed notes on everything that you observe. To take pictures or make sketches of your observations whenever doing so would make things clearer.

And don't forget to think about the display that you will eventually need to make to show off your work to the science fair judges. Your notes and your photos WILL be vital!

• **Step 6: Figure Out What Happened and What it Means**

As soon as you are finished with your experiment, it is time to organize your notes. (It's OK to recopy your notes so that they are more organized and can be easily understood by others.)

Next, analyze your data.

Ask yourself, what happened? Did the results agree with your hypothesis? Make graphs and charts that will help you "see" what the data mean.

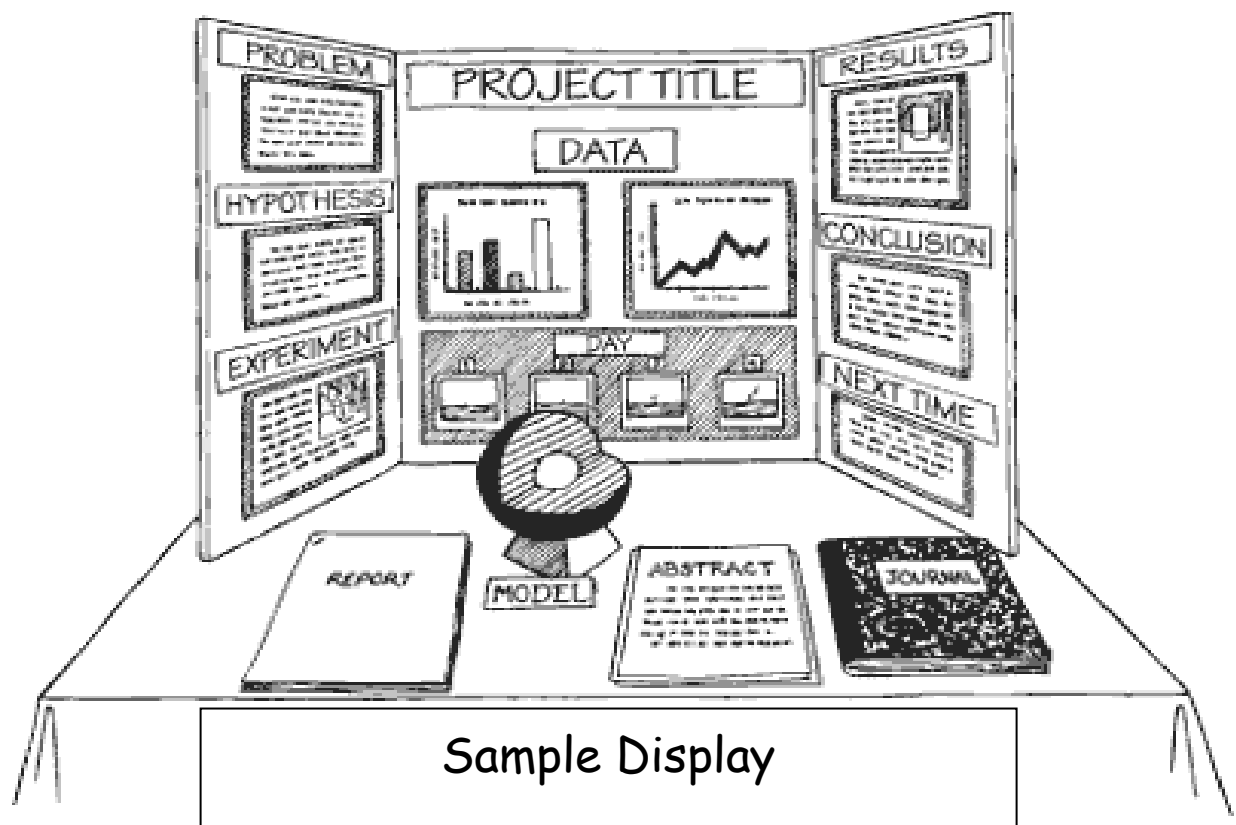
• **Step 7: Create Your Charts and Graphs**

Create charts and graphs that will give a visual to your data you collected during your experiment. You might want to sketch these in your log book. You can also use computer programs like EXCEL to create graphs. Another great site is nces.ed.gov/nceskids/ to make graphs easily.

• **Step 8: Make Your Display**

No matter how good your experiment, you can't expect to win your science fair without a killer display.

Your display is crucial because it is your vehicle to connect with the judges and the public to let them know just what a good job you did. The display must be neat and well organized. It should include background information, the problem, your hypothesis, your procedure, your results, your conclusion, your research, and graphs and charts. In other words, the steps of the scientific method ARE WHAT WE ARE TALKING ABOUT! You can also include photos or drawings of your experiments.



- **Step 9: Don't Glue It Tight Until You Have It Right!**

Don't place anything on the backboard until you make sure it is spelled correctly, cut out neatly and **IS REALLY THE FINAL PRODUCT!** Make your title catchy...something people will remember. Even though we do not judge a science fair project on "pretty," pretty and neat gets attention and that is what we want from the science fair backboard...**ATTENTION!**